REMARKS

Claims 43-77 remain in this application. Claims 1-42 have been canceled, without prejudice. By these amendments, no new matter has been added.

The present invention provides a hydrogen storage system, and method of making it, that includes a storage material comprising a nanostructured material, i.e., a plurality of nanostructures. The plurality of nanostructures are characterized by being comprised primarily of light elements, and having a characteristic shape, such as nanotubes, nanoplatelets, etc. The storage material is further characterized by having a binding energy to adsorbed hydrogen substantially greater than about 0.10 eV, which is much greater than prior art hydrogen-adsorptive storage materials. This higher binding energy results in much higher desorption temperatures, in some cases approaching or exceeding the temperature of liquid nitrogen. Thus, the invention represents a significant step forward in hydrogen storage technology, without the many disadvantages of chemical storage technologies such as metal hydride systems.

It is believed that the increase in binding energy results from modifying or distorting the covalent sp^2 bond structure in the molecular lattices of the adsorptive material's nanostructures. Such modifications or distortions may be introduced in essentially three different types of systems. A first type of system uses nanostructures that are non-planar. These nanostructures have a lattice structure that is curved, and hence present a distorted triangular lattice. The distorted lattice has a higher affinity for absorbed hydrogen and a higher desorption temperature, as compared to planar nanostructures of the same materials. This first system is defined by Claims 43-47.

A second type of system uses nanostructures comprising a combination of a least two different light elements. These nanostructures also present a distorted (i.e., not perfectly equiangular triangular lattice structure), regardless of whether or not they are planar. This second system type is defined by Claims 48-55.

A third type of system uses a storage material that includes nanostructures with molecular lattice defects. These defects also disrupt the sp^2-bonded triangular lattice, thereby increasing the binding energy for adsorbed hydrogen. The defects may be introduced in various different ways.

This third system and various forms of defects are defined by Claims 55-63. The three types of systems may, of course, be combined in various ways. Claims 64-77 define a method for making a hydrogen storage system, including each of the three types of systems generally described above.

The Examiner rejected Claims 1-41 under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1-41 have been cancelled. These rejections are therefore moot, and should be withdrawn. It is not conceded that the phrase "modified sp^2 bonds" is indefinite. However, to avoid unnecessary argument, alternative language has been used to define the hydrogen storage systems disclosed in the specification. Thus, new Claims 43-77 do not contain the "modified sp^2 bonds" phraseology that was the basis for these rejections, and are believed to be sufficiently definite.

The Examiner rejected Claims 1-41 under 35 U.S.C. § 112, first paragraph, as not enabled. Again, these rejections are moot in view of the cancellation of Claims 1-41, and should be withdrawn. In addition, § 112, first paragraph poses no bar to patentability of new Claims 43-77. The specification provides a detailed description of how to construct nanostructure materials as defined by the claims, i.e., nanostructures with curved molecular lattices, with lattices incorporating a combination of different light elements, or with lattices incorporating a plurality of defects, so as to achieve a hydrogen binding energy greater than 0.10 eV. Numerous specific examples of fabrication methods and resulting hydrogen binding properties are provided in the specification. Using the detailed description and examples, one of ordinary skill would be able to make and use the invention without undue experimentation.

The Examiner rejected Claims 1-30 and 34 under 35 U.S.C. §§ 102(e) or 103(a) in view of Zaluska, and Claims 1-29 under 35 U.S.C. §§ 102(e) or 103(a) in view of Feiner, Tracy Hall or Weng-Sieh. The rejected claims have been cancelled. These rejections are therefore moot, and should be withdrawn.

In addition, Zaluska, Feiner, Tracy Hall and Weng-Sieh pose no bar to patentability of new Claims 43-77. Zaluska discloses a hydrogen storage system using a metal hydride material, which operates by chemically bonding hydrogen to a metal. Zaluska fails to disclose or suggest a plurality of nanostructures having hydrogen-adsorptive properties, as defined by Claims 43-77. Even more so, Zaluska fails to disclose or suggest providing nanostructures with curved lattices, with lattices

incorporating a combination of different light elements, or with lattices incorporating a plurality of defects, so as to achieve a hydrogen binding energy greater than 0.10 eV, as also defined by these claims. Zaluska therefore cannot anticipate or make obvious any of Claims 43-77.

Tracy Hall and Feiner merely disclose the creation of compounds including two or more light elements. Feiner discloses a BeB_2 compound, and Tracy Hall discloses B_2O and other unsymmetrical, isoelectronic two-atom analogs of carbon. Neither of these references are at all concerned with adsorption of hydrogen by a storage material, as defined by Claims 43-77. Both Tracy Hall and Feiner fail to disclose or to suggest fabrication of nanostructures of any type. These references also fail to disclose or to suggest using compounds of different elements to absorb hydrogen. Feiner and Tracy Hall therefore cannot anticipate or make obvious any of Claims 43-77.

Weng-Sieh discloses a nanotube formed of a BxCyNz material. However, Weng-Sieh is not at all concerned with hydrogen storage, and fails to disclose or to suggest hydrogen adsorbed by a storage material, as defined by Claims 43-77. Nor does Weng-Sieh or any other reference provide any suggestion that nanostructures might be useful for hydrogen storage. Weng-Sieh also fails to disclose or suggest a plurality of nanostructures configured with a plurality of lattice defects, as defined by Claims 55-63. Therefore Weng-Sieh, either alone, or in combination with either or both of Feiner and Tracy Hall, cannot anticipate or make obvious any of Claims 43-77.

Presently, cancelled Claims 32-33 and 35-41 have not been rejected in view of any prior art reference. For the Examiner's convenience, Applicants point out that new Claims 68-69 and 72-77 define similar subject matter as the cancelled Claims 32-33 and 35-41.

In view of the foregoing, the Applicants respectfully submit that Claims 43-77 are in condition for allowance. Reconsideration and withdrawal of the rejections is respectfully requested, and a timely Notice of Allowability is solicited.

To the extent it would be helpful to placing this application in condition for allowance, the Applicants encourage the Examiner to contact the undersigned counsel and conduct a telephonic interview.

No fees are believed to be due in connection with the filing of this response. However, should it be deemed otherwise, the Commissioner is hereby authorized to charge any necessary fees to Deposit Account 50-2862.

Respectfully submitted,

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